Cement MILL SECTION of

Concrete

Vol. 24 MARCH, 1924 No. 3

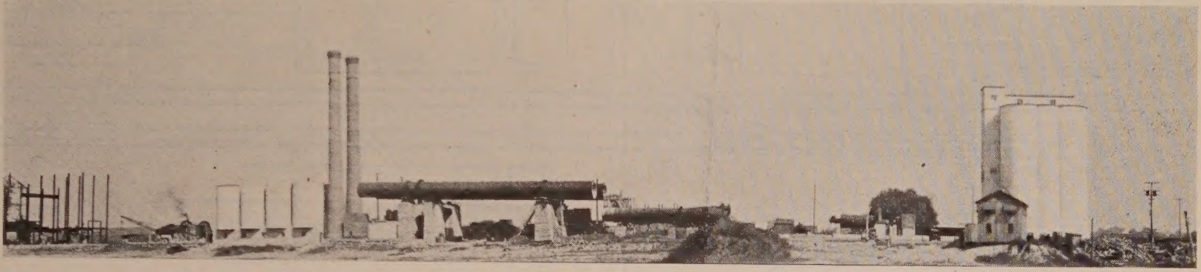


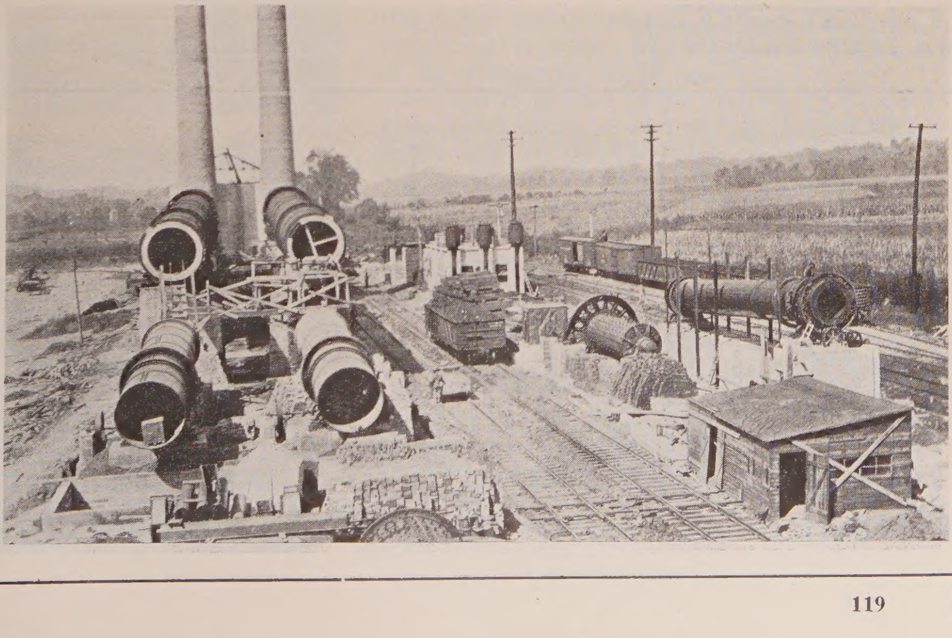
Fig. 1—General View of the Hermitage Portland Cement Co.'s Plant, Nashville, Tenn.

Hermitage Portland Cement Co.'s Plant Nears Completion

The new wet process plant of the Hermitage Portland Cement Co., located at Nashville, Tenn., is now receiving the finishing touches. As shown in the accompanying general plan of the plant, it is of the straight line design, and it is the aim of the men in charge of the design and building of the plant to make it one of the most modern of its kind. Completed at a cost of about $1,000,000, the plant rivals in rapidity of construction the building of Old Hickory Powder Plant, near Nashville, when all was sidetracked for speed. On the morning of July 4, last year, the first blast was set off in the Hermitage quarry and loosened sufficient limestone and clay for 3 months' operation of the plant. Only about 6 months intervened between the first breaking of ground at the plant and the crushing of the first rock in the crushing plant.

The capacity of the Hermitage plant is 2,000 bbls. per day, and it is planned to sell this output throughout middle and western Tennessee, southern and western Kentucky, northern Alabama and northern

Fig. 2—View Looking North from the Silos Along the Straight Line Layout of the Plant. The Kilns and Coolers Are Shown on Their Foundations with the Kiln Stacks in the Background and the Clinker Pit in the Foreground



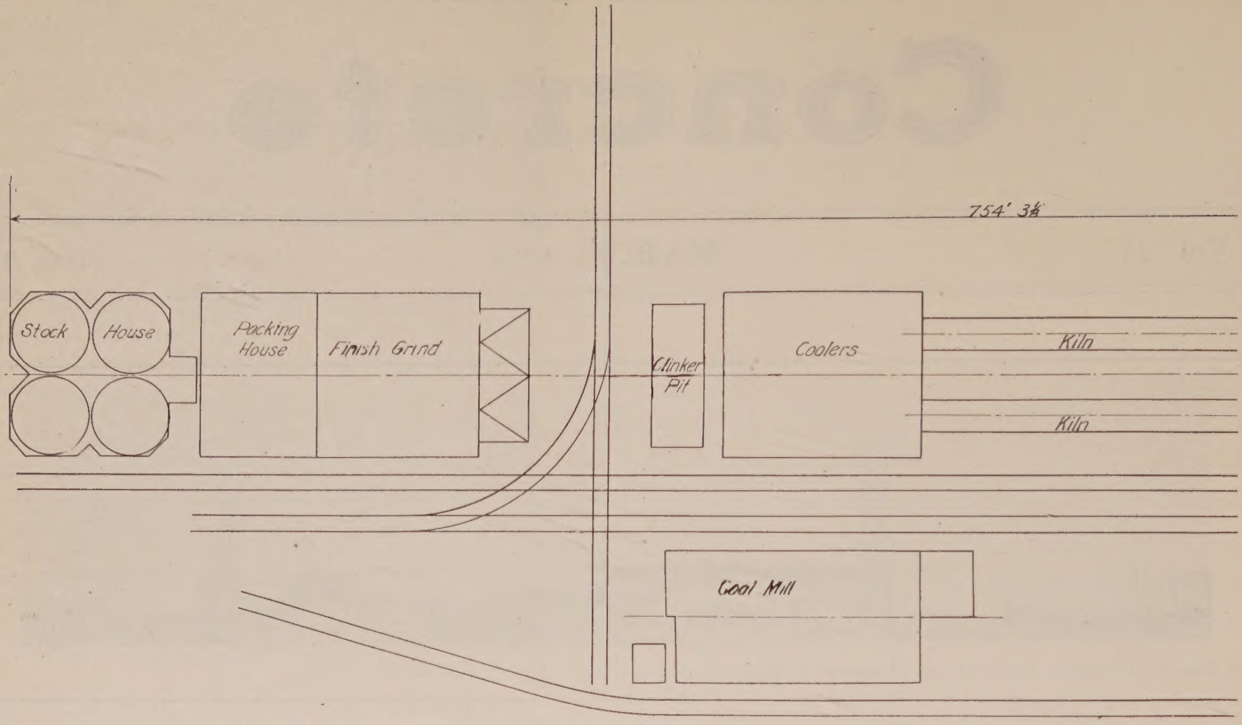


Fig. 3—General Plan Showing the Layout of the Hermitage Plant

Mississippi, with the city of Nashville itself taking considerable percentage of the product.

Limestone and clay are used as the raw materials. The quarry and clay pit are located within 2,000 ft. of the plant, the quarry being on a side hill with very little overburden. Armstrong electric drills[1] are used in the quarry, preparatory to blasting. The broken rock is loaded by electric shovel[2] into 6-yd. standard side-dump cars[3] and hauled by a saddle tank locomotive[4] to the crusher.

The crushing department, shown on the extreme left of the general view of the plant, consists of one No. 18 and two No. 5 Gates gyratory crushers.[5] From the 60-in. x 16-ft. revolving screen,[5] the stone is delivered to the two 7-ft. x 22-ft. raw grind compeb mills[5] by a belt conveyor. There are no rejects, the oversize stone from the screen going to the secondary crushers.

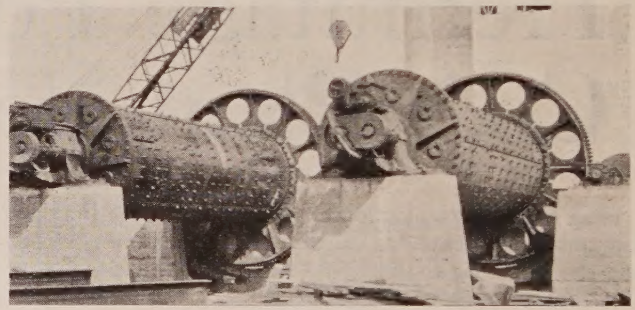


Fig. 5—The Two Finish Grinding Compeb Mills with the Silo Storage in the Background

Rock is stored in the open to be reclaimed by locomotive crane.[6] Clay from the wash mill[5] is introduced with the limestone at the raw grind compeb mill.[5] Steel bins above the raw grind compeb mill supply the material for the mill. No automatic weighing

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[1] Armstrong Mfg. Co., Waterloo, Ia.

[2] Marion Steam Shovel Co., Marion, Ohio.

[3] Kilbourne & Jacobs, Columbus, Ohio.

[4] Davenport Locomotive Works, Davenport, Ia.

[5] Allis-Chalmers Co., Milwaukee, Wis.

[6] Brown Hoisting Machinery Co., Cleveland, O.

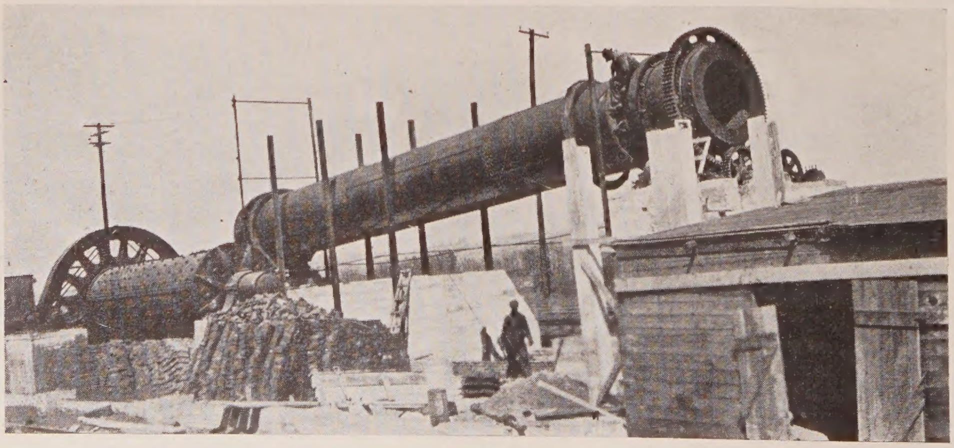
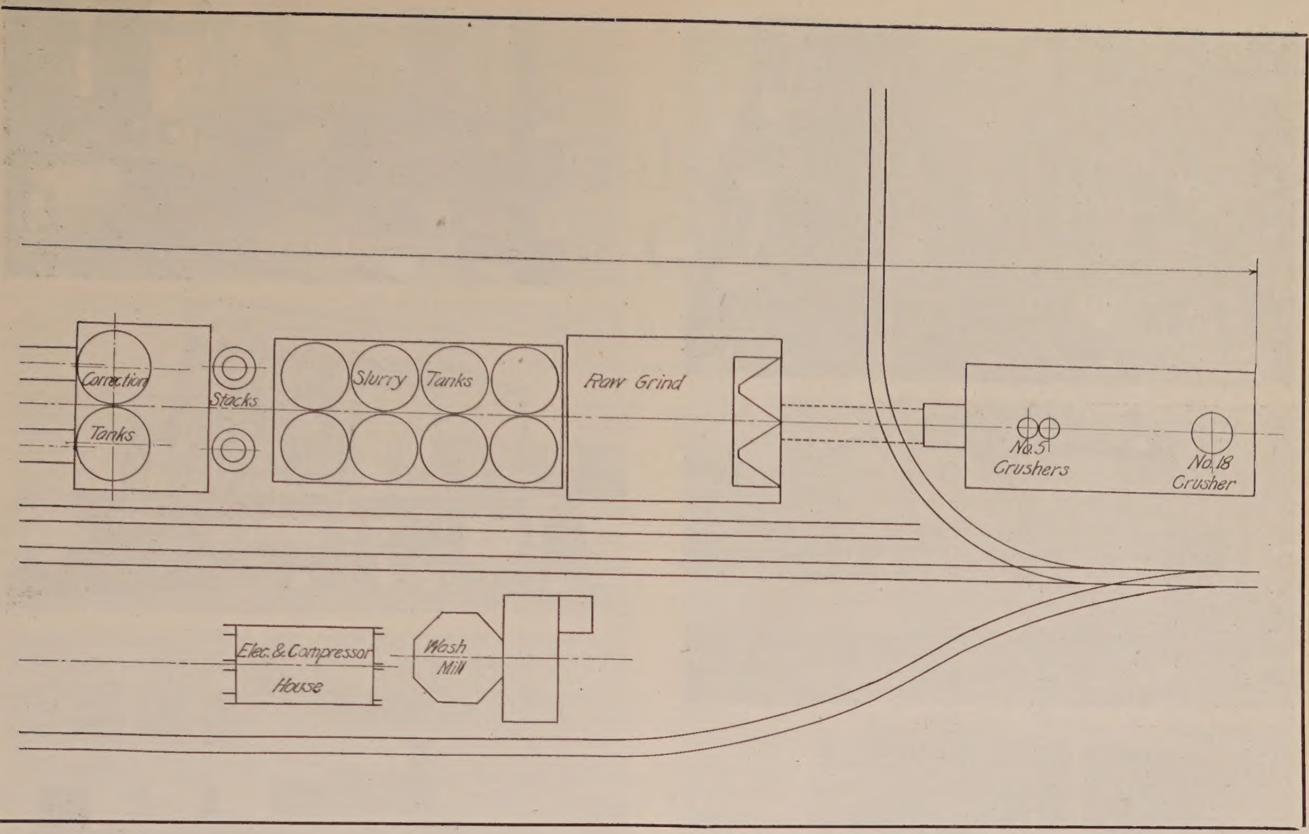
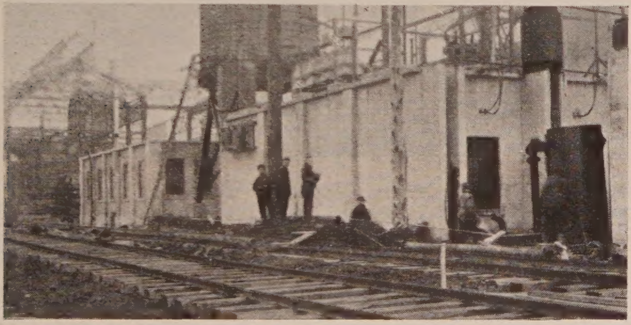
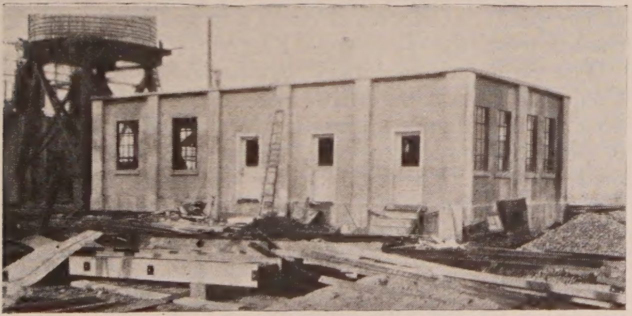


Fig. 4—Coal Dryer and Compeb Mill Being Erected in the Coal Department







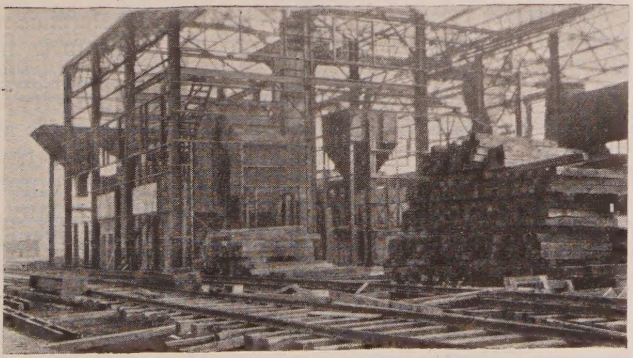


Fig. 6—Electric and Compressor House; Laboratory; Coal Mill

Fig. 7—Laboratory

Fig. 8—Coal Mill

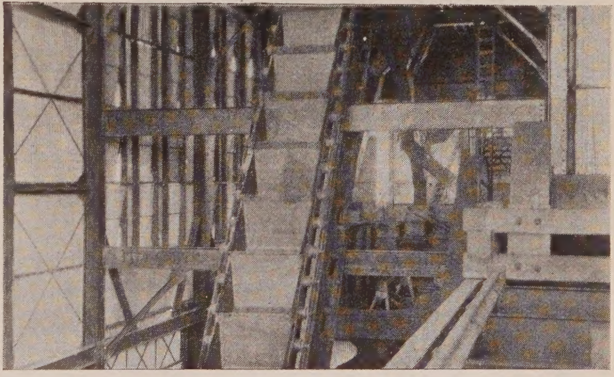


Fig. 9—42″ Pan Conveyor (in Crushing Department)

devices are used, but the material is conveyed directly from the screens to the compeb mills.

From the raw grind mill, the slurry is pumped to the slurry storage tanks[7] of which there are 8, constructed of concrete, and having a combined capacity of approximately 50,000 gal.

Air slurry pumps pump the slurry to the storage bins. The slurry is agitated by means of air introduced into the slurry basins. There are two correcting basins provided, of concrete construction, each 22 ft. in diameter and 18 ft. high.

The burning department consists of two 10-ft. x 150-ft. rotary kilns[5] which discharge into 8- x 60-ft. coolers. A locomotive crane[6] handles the clinker from the discharge end of the coolers, transporting it to the storage pile and feeding it to the finish grinding compeb mills. The clinker is ground by two 7- x 22-ft. compeb mills[5] without air separation.

The stock house for finished cement consists of four concrete silos[7] having a combined capacity of 40,000 bbls. The silos were built by the sliding form method, each bin being 22 ft. in diameter and 70 ft. high. From the finish grinding compeb mills, the cement is

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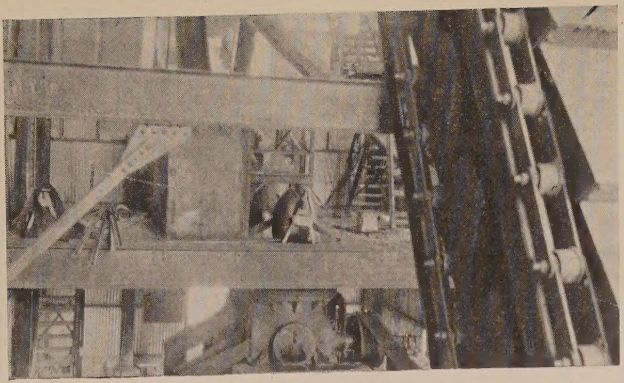
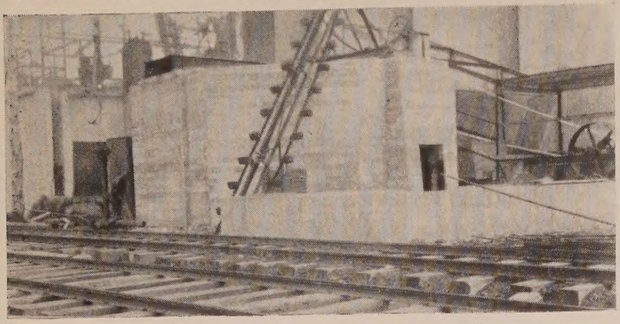
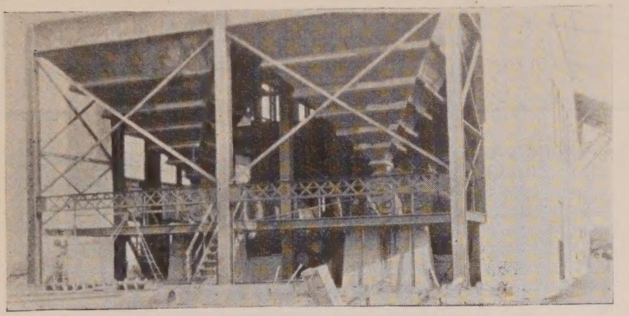
[7] Bland Engineering Co., Minneapolis, Minn.







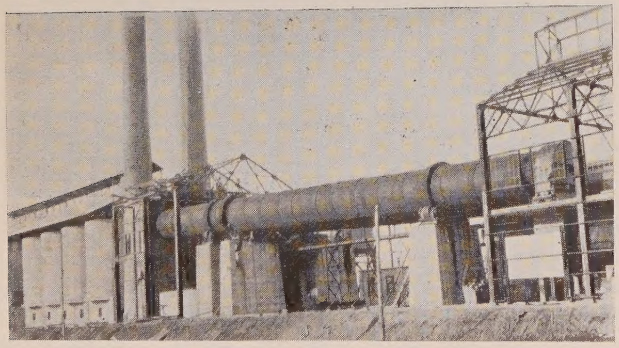
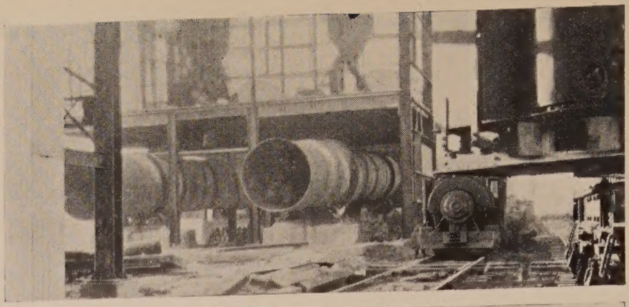
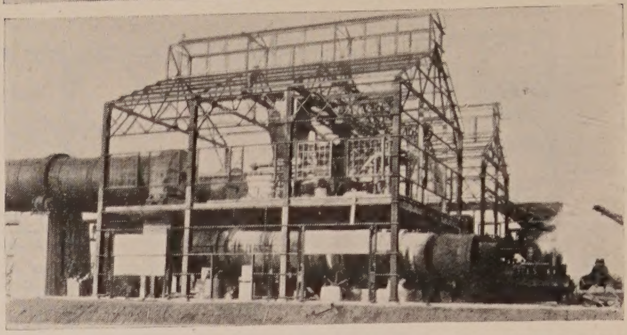


Fig. 10—No. 5 Crushers; 42″ Pan Conveyor Section on Right
Fig. 11—Wash Mill
Fig. 12—Clinker Bins; Finish Grind Compeb Mills
Fig. 13—Kilns and Slurry Tanks





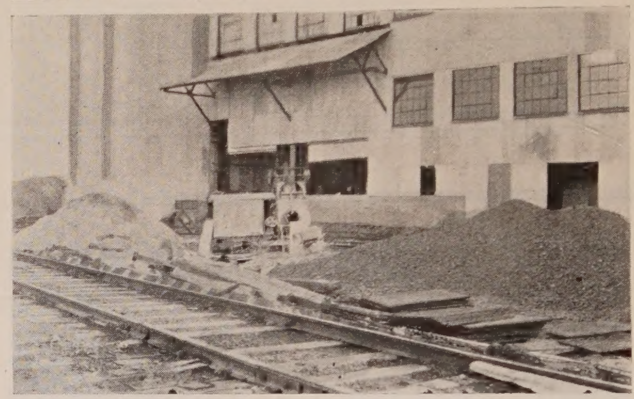


Fig. 14—Discharge End of Coolers. Firing Floor Above
Fig. 15—Discharge End of Kilns, Coolers, and Firing Floor
Fig. 16—Outside of Packing House. Silos Shown at the Left

transported by elevator[8] and screw conveyors[8] for distribution into the bins of the stock house. Two Bates valve baggers[9] in the packing department prepare the cement for shipment.

The Coal Department

Powdered coal is used as fuel. The main equipment in the coal mill consists of one 6- x 60-ft. Ebro type rotary dryer[5] and a 6- x 22-ft. compeb mill,[5] as shown in Fig. 3. The coal mill is placed at the side of the straight line layout of the main plant directly opposite the firing end of the kilns, and the powdered coal is injected into the firing end of the kilns by means of the air jet.

The mechanical units of the plant are all electrically driven by individual motors.[5] No power is generated at the plant, as electrical energy is available and purchased from the Tennessee Electric Power Co.

The principal machinery was furnished by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The buildings housing the main equipment are of steel and concrete of permanent construction. Structural steel was furnished by the Nashville Bridge Co., Nashville, Tenn. Air compressors were furnished by the Ingersoll-Rand Co., New York City, and hoist and car puller by the Stephens Adamson Co., Aurora, Ill. The Laclede Christy Clay Products Co., St. Louis, Mo., furnished fire brick for the kiln linings.

The plant is strategically located with reference to railroad facilities for getting coal and gypsum to the site and for shipping the finished product. It is located on spurs from all three railroads serving the city of Nashville. The ease with which the raw materials are obtained, the abundant water supply available from wells, river or city water mains, and the shipping facilities to and from the plant give the company a natural advantage in the cement field. The cement will be marketed under the brand name of "Hermitage."

The officers of the company are: John C. Vance, president; T. L. Herbert, Jr., vice president; R. D. Herbert, secretary-treasurer; R. T. Miller, general manager; William Fowden, general superintendent. The experience of the officials of the company and their intimate knowledge of cement and its uses are largely responsible for the success of the project.

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[8] Weller Mfg. Co., Chicago, Ill.
[9] Bates Valve Bag Co., Chicago, Ill.

Some Fundamentals of Big Blast Hole Drilling for Quarry Work

By M. B. Garber
Sanderson Cyclone Drill Co.

Abstracted from a paper delivered at the Seventh Annual Convention of the National Crushed Stone Convention, at St. Louis, Jan. 22, 1924.

When the well drill was being introduced to quarry work it was necessary to demonstrate to quarry operators the advantages of big hole drilling and blasting. There may be a few operators of quarries scattered here and there who are still employing the old benching methods, and who, for various reasons, have hesitated in the installation of a big blast hole drill, but who, unless they have some peculiar conditions, cannot hope to compete with their neighbor operating by the well drill method.

Today the well drill or big hole method of drilling and blasting, as a method, is an accepted fact and the quarry drilling problem has narrowed down to the matter of obtaining the lowest possible drilling and blasting cost per ton of material excavated. In many quarries, especially those producing hard rock, drilling is the most difficult and perplexing operation, possessing what may be termed intangibility or the inability of being quickly remedied when difficulties are encountered.

No quarry man should be without a good working knowledge of the operating fundamentals of big blast hole drilling, and their application to his own particular rock moving job, all of which has to do with the putting down of holes in the best, cheapest and quickest way possible and to do this so that nothing else on the flow sheet will suffer. Very little has been written on this particular subject to date. Most of the information has been passed around from mouth to ear, or each quarry has worked out its own problems to a certain degree.

In passing, it might be said that, in arranging an operating program and in the deduction of final costs, drilling and its affiliated operation, blasting, must be considered together. This refers to the diameter, spacing and loading of the holes and the strength of explosive to be used, but blasting has no interest in how the hole is going to be drilled as long as it is there and ready for the explosive, nor has drilling, in itself, any concern how the explosive will get in the hole and how it will be fired. Thus considered, the two are entirely separate and individual.

Importance of a Properly Balanced Tool Equipment

In big blast hole drilling, which, defined, is an application of the cable tool system of well drilling to heavy rock excavation, the drill hole is made by the alternate lifting and dropping of a heavy bar with a cutting end, which forms the drilling tools. As much, or more, hole is made due to the crushing effect of the heavy bar as results from the chopping action derived from the sharpened cutting end, which is known as the drill bit.

Therefore, three basic conditions are important in the make-up of the quarry drilling outfit. First, to have tools of sufficient weight to secure a good crushing action. Second, to be able to lift and drop the tools at sufficient distance to take full advantage of the crushing action derived from the heavy weight of the drilling tools, this being the problem of the mechanism of the machine which operates the drilling tools. Third, to have a drill bit of the proper material and properly sharpened for the stone being drilled.

Considering first the drilling tools, quarry men know that 5⅝ to 6-in. holes are considered more or less the standard for big blast hole drilling in what may be termed the average quarries, which, for clarity, may be described as limestone, dolomite or sandstone operations, carrying working faces ranging from 20 to 25 ft. up to 100 ft. in height and producing from 300 to 30,000 tons of crushed stone per day. Present practice recommends for this average quarry a drilling tool equipment weighing approximately 1,250 lb., consisting of a drill bit weighing about 200 lb., a drill stem 4¼ in. in diameter, by 20 ft. long weighing about 960 lb., and a rope socket weighing about 90 lb. A few years ago the common practice for the same work was a drill stem 3¾ or 4 in. in diameter and from 16 to 20 ft. long, making a tool equipment varying in total weight from 850 to 1,000 lb. It has been proved very conclusively that the extra 250 to 400 lb. will add from 25 to 40% to the drilling speed.

Experience so far indicates that drilling tools of the size and weight just mentioned, namely about 1,250 lbs., are as heavy as should be recommended for the ordinary quarry of the characteristics as previously described, and it is very improbable that the future developments will prove that the use of much heavier drilling tools would be practical because, as the weight of the drilling tools is increased, the weight and strength of the drilling machine that operates them must be increased proportionately. Thus, a point is reached in the weight of the entire drilling outfit which affects its portability and determines whether or not it can be quickly and economically moved from hole to hole and will not be cumbersome or unwieldy. Furthermore, holes 5⅝ or 6 in. in diameter have proved satisfactory for blasting purposes, allowing ample room for column loading of explosives and, when properly spaced and loaded with regard for local quarry rock formation, give very good all-round results.

Care of Drilling Tool Taper Joints

Too much care cannot be given the taper joints. Experience has shown that joints are often spoiled, either through a lack of understanding or through carelessness, and this is often a source of expense and inconvenience in the operation of a blast hole drilling outfit.

When new drilling tools arrive on the job, the joints will always be well greased in order to prevent rusting. Before using the tools, all of this grease should be removed and the threads carefully washed clean with gasoline or kerosene. Then a little water should be put on the threads each time they are drawn up, which will furnish all the necessary lubrication. It is impossible to set a taper joint with grease on it.

It is extremely important that new joints be properly broken in or set. This process will take from several hours to a week, depending on the hardness of the rock and also somewhat on the steel in the joints. The first time new joints are put together they should be screwed no tighter than one man on the end of the wrenching bar can pull them, exerting a reasonable amount of strength. It is a good idea at this time to take a punch or cold chisel and mark both collars for future reference. This will not be a final reference mark, because after the tools are in operation for a while it will be found possible to set them up closer, due to the fact that the shoulders of both the box and pin collars are compressed by the heavy pounding, and, unless the joint is tightened again, the threads alone will be carrying the strain of the connection instead of the shoulders. For this reason, it is necessary to watch new joints carefully, and at frequent intervals tighten them to prevent them from coming unscrewed in the hole. On hard rocks like granite, trap and some limestones, it will be found that the marks made on the collars will be one-fourth to two-thirds of a turn from one another after the joints are properly set, while on softer material the marks may not be more than one-fourth to one-half inch apart. It is then a good idea to re-mark the joints for final reference, providing they cannot be tightened more.

After joints have been used for a while, the abutting shoulders will sometimes become rough and burred on the edges. A straight-edged pumice stone should be kept around the drill for the purpose of dressing the shoulders perfectly smooth and for grinding off the burrs to prevent them from turning in on the shoulders and making it difficult to tighten or loosen the joint. A file should never be used, because it cuts too rapidly and leaves marks which tend to cause the shoulders to roughen again when setting up the joints or to make the shoulders uneven.

A common mistake in handling joints in quarry work is to try to screw them too tight.

Double Box Joints on Drill Stems

In blast hole drilling, the joint that takes the most severe punishment is the box joint on the drill stem which connects with the pin joint of the drill bit. As this joint bears the bulk of the vibration, and, due to the heavy hammering action of the drilling motion, there is a tendency for the steel in this joint to become fatigued and eventually fail, it is this joint that will require the most frequent repairs. On hard rock, or even rock of medium hardness, drill stems fitted with two box joints, that is, a box joint on either end, are found to give double life and result in great saving in tool repair costs. When stems of this kind are furnished, the rope socket must be fitted with a pin joint instead of a box joint. With the two-box joint construction, the stem is changed end for end at intervals, thus allowing the fatigued steel in one box joint to rest while the other box joint is in strenuous use.

The Shape of Drill Bits

The most important single item of a quarry drilling tool equipment is the drill bit, as there are many things about it that have to do with successful blast hole drilling. There are several patterns of drill bits, the one that is most often used in quarry work being the regular pattern, or what is commonly known as a chisel bit. There is also a four-bladed or cross bit, known as a star bit, that is sometimes used for creviced rock, although a thick-bladed chisel bit often will give equally good results, provided the cutting edge of the bit is properly shaped and the tools are properly operated.

The shape of the cutting edge of the drill bit is one of the important factors in making hole, and on it depends whether or not any advantage is to be gained through the chipping action or whether all must depend upon the crushing action of the weight of the tools. Quarry drillers who sharpen bits at the drilling machine, as well as local quarry blacksmiths, have developed a greater variety of cutting edges on well drill bits than there are pages in Noah Webster's masterpiece. However, it is not possible to lay down infallible rules in regard to the proper shape of the cutting edge of the bit for a given kind of rock. This is even true of rocks of the same geological family, due to the fact that their drilling or chipping qualities will vary greatly. It is necessary to experiment, and then, having obtained a shape that gives the most footage, to insist upon uniformity thereafter in sharpening bits.

On the other hand, there are certain general principles governing the shape of the cutting edge of bits that must be followed if maximum footage is to be secured. The water channel must be kept clean. The cutting edge should be straight tending toward a little concave, but under no conditions convex. The bevel or angle between the surfaces forming the cutting edge should be determined by the chipping qualities and hardness of the rock.

When drilling in abrasive and in hard rocks, the bit must be dressed with heavy shoulders on the sides above the corners in order to maintain the shape. In addition, in abrasive rock or where there is a tendency for the tools to drift, the cutting edge should have heavy wearing surfaces, a wearing surface is made by pulling out the upper edges of the beveled faces so that they almost fill the hole. It should be mentioned, though, that if the rock is only hard and not abrasive, a wearing surface is a positive disadvantage, because it furnishes additional friction in the drop of the tools and also causes more or less of a plunger action.

For most soft formations, very little or no wearing surface and shoulders are required. The corners of the cutting edge should be drawn out thin and sharp, making what is known as a feather edge, so that the bit will not stick as it plunges into the material. The degree of bevel will vary from very sharp for shelly rock like slate and some hard shales to almost blunt on extremely soft formations where the drill bit plunges forward more quickly than it is possible to mix the material into a sludge.

Care of Drilling Cable

The most economical length of drilling cable to use is one approximately 75 ft. longer than the depth of holes to be drilled. This length permits the cable to be turned end for end when the end next to the tools becomes worn, and also allows the making of several splices.

When rope is spliced, a long splice should be made, even though it does take more rope and sometimes a little more time. A short splice is hard on the rope guards and sheaves, especially the latter, as it crowds and often bursts the sides of the groove, being too large in diameter to pass through the throat of the sheave.

Lots of drill rope is worn out every year, not through the strain of drilling, but back at the cable drum where the rope takes off to the spudding device. There is always some vibration of the cable at this point, and, due to the top wrap of rope wedging down between the coils of the next layer, the constant rubbing or friction burns the rope. To eliminate this wear, a cable divider should be placed on the drum, so that the unused part of the rope is coiled on one side of the drum, while on the other side only enough rope should be spooled for feeding off in hole and in only one layer. Furthermore, it is important that the surface of the drum be smooth.

It is very necessary that the proper tension be kept on the drill rope while the tools are in motion. The tendency of most drillers is to run with the rope too slack, which causes excessive vibration and internal friction that results in the rope being burned out in the heart, and in it giving only about one-fourth to one-half the service that it should give. Drilling on the "spring of the rope" is the term used when the proper amount of tension is being maintained in the cable in order to secure the snappy blow that gives the maximum footage. To determine the amount of tension, stop the tools on the down stroke just as they are stiking a blow, then raise them from 1 to 3 in., depending on the depth of the hole, and put them in motion again. Once in a very great while, drill men will run with too tight a rope, which results in all the spring or stretch and life being taken from the rope.

Hitting the Bottom of the Hole

In addition to drilling on the spring of the rope, the drilling machine should operate the drilling tools at a speed of 55 to 60 strokes per min., 60 strokes being considered as the desired speed if there are no seams or crevices in the rock and the holes do not exceed 50 ft. in depth. Furthermore, the longest stroke of the drilling crank of the drilling machine should be employed. By drilling on the spring of the rope and at the proper speed, the drill cuttings and sludge are always churned up and in suspension, thus permitting the drill bit to hit a clean as well as a snappy blow on the bottom of the hole. Otherwise, the cuttings tend to act as a cushion, which hinders the drilling progress in two ways. First, as the tools do not hit the bottom of the hole, the hole is not advanced. Second, the abrasive effect of the cushioning on the drill cuttings wears the bit steel and cuts the gage on the drill bit much faster than does solid rock itself.

From what has just been said, it can be seen that bailing or cleaning of the hole must not be neglected. The frequency of bailing is something that is governed entirely by the nature of the rock being drilled. For practically all quarry drilling, the ordinary dart valve type of bailer is all that is required. This is the type of sludge pump that is usually furnished. When drilling in sandstone or in hard and abrasive rocks or rocks which contain a large amount of minerals, which will not form a sludge and in which the cuttings settle rapidly to the bottom, a bailing tool known as a vacuum sand pump is sometimes used. A vacuum sand pump is provided with a plunger which operates the full length of the bailer shell and creates sufficient suction to sweep the bottom of the hole clean, drawing all the cuttings and the sludge into the pump. However, even on materials of this kind, many drillers prefer to use the ordinary dart valve bailer, and secure their sludge by mixing soft coal or stiff clay in the hole in order to keep the heavy cuttings in suspension.

It might be mentioned at this time that the sludge of certain sandstones, such as are used in making molding sand, and also of limestone containing siliceous matter have the characteristic of settling very quickly. In such formations precaution must be taken not to allow the drilling tools to rest at the bottom of the hole, because the quick settling cuttings or sludge will cement them tight in the hole in a very few seconds.

Handling Seams, Crevices and Crooked Holes

This leads to the handling of special or rather unusual problems that are encountered in quarry drilling. Many of these problems are more or less common to several kinds of rock, while, on the other hand, there are quarries whose rock formations are such that none of these difficulties will be met.

In thinly stratified limestones and in metamorphic and igneous rocks, such as traps, quartzite and granites where the cleavage lines are close together, alternate layers may vary in hardness. When the drill bit breaks through from one layer into a softer one, there is an inclination for the tools to stick. This can be offset by keeping tight tension in the drilling cable. It is also absolutely necessary that the drilling tools keep turning, otherwise the bit will drive down into the softer material and drill ahead without turning. This will not only result in a flat hole, but it may cause a crooked hole.

Such conditions prevailing where the stratification or cleavage lines lie at a high angle approaching the vertical, the dangers are very much increased, as the bit will cut the softer layers first and the tools will be deflected to the softer side, and will either be stuck or a slanting hole will result.

If there are open joint planes or crevices in the rock, as so often occur in granite and trap rock and in the limestones of the Appalachian district, much the same troubles are encountered, only often in an aggravated form, as the tools will drift into an opening before the driller is aware that anything is wrong.

Before mentioning remedies for these conditions, the preventives should again be emphasized.

First: The drill man must be on the alert every moment the tools are in motion, with his hands on the drilling cable so that he knows what is going on.

Second: The drilling cable must be in proper tension.

Third: The tools must be kept turning.

Assuming that the drilling tools have become fast in a crevice while part of the stem and rope socket are still out of the hole, they can be very often loosened by taking a tight strain on the drill rope, going up on the derrick, putting a tool wrench on the top square of the tools and then hitting the wrench with the sledge in the same direction that the tools are tightened.

The method of loosening fastened tools after they are below the surface is to take a strain on the drilling rope, place the bumper or jar knocker which is furnished as part of the equipment on the sand line, and lower it down to the top of the rope socket. Then, by hand, pull on the sand line so as to raise the bumper 1 ft. to 18 in. and strike light blows. This will very often release tools, unless they are extremely tight. If this does not loosen them, the next proposition is to run the bumper up and down on the drill rope by pulling up and releasing the sand line. This, however, is hard on drilling cable.

Both of these ways of loosening the tools having failed, a fishing job is at hand, and it will be necessary to cut the rope at the top of the rope socket and apply fishing tools, consisting of long stroke fishing jars and a combination socket.

If the crevice or crooked hole is discovered before the tools become tight in the hole, the tools should be hoisted and some method applied immediately for the purpose of eliminating the crevice or for straightening the hole. There are several ways of doing this. One way is to put foreign material in the hole, such as cast iron and small pieces of steel. If cast iron is employed, start with one piece and drive it down into the drill hole. If this does not seem to do any good, put in two or three more pieces. However, as little cast iron as possible is best—just enough to carry the tools so that they can get a hold on the rock and pass the crevice. The bit should be dressed so that it is very blunt but with a full wearing surface. The iron and steel will keep the bit working at one point a long time, thus giving it a chance to take hold of the rock, and it will also force the steel and iron out against the sides of the hole with such force that it will chip away the rock, thus assisting the bit to "eat out" the crook.

Another method of correcting a slanting hole is to fill the hole up past the crook with small pieces of rock or boulders. If pieces of conglomerate known as niggerheads are available, they are excellent for this purpose. It is necessary then to drill these pieces of rock out. Still another way of straightening the hole or passing a crevice is to drive a block of timber of such size as just about fits the hole down past the crevice or the crook in the hole. After the timber has been seated, the drilling tools are placed in the hole and the block is drilled out. The tools should be run on a very tight cable and with the bit dressed blunt. A piece of green oak is best for this purpose. This method is best adapted for rocks of medium hardness.

If a stubborn crevice or crooked hole is encountered and one or all of the above methods have been tried several times and have failed, the desired results can often be obtained by firing several sticks of dynamite in the hole. Anywhere from 5 to 50 lbs. may be used, although as little as possible to secure the necessary results should be used, as an excessive amount will shatter the hole very badly and be a menace to the tools in proceeding with the hole, because the shattered fragments may fall in and around the tools.

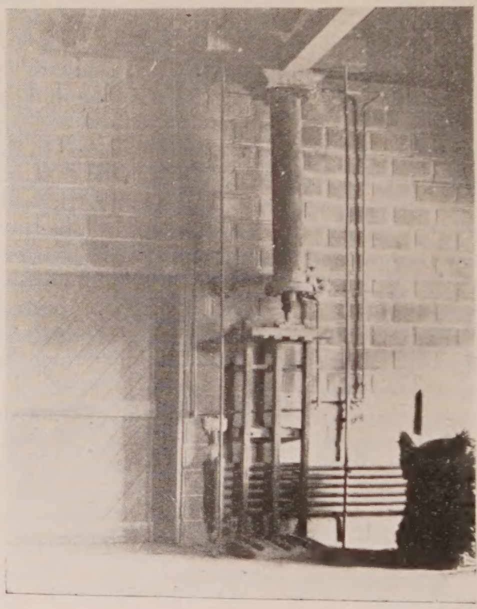
In very hard or abrasive rock, where it is necessary to carry blast holes to considerable depth and there is a great deal of trouble in holding the gage on the drill bit or, in other words, maintaining the original diameter of the hole, it is a good practice to "burn" the hole before putting in a freshly dressed bit. This can be done by pumping the hole out absolutely clean and throwning in ½ to 1 lb. of dynamite and a couple of buckets of water on top of it to hold the shot to the bottom of the hole. The action of the small amount of explosive will enlarge the hole enough to take care of any loss of gage on the previous bit. Many fishing jobs are the result of a freshly dressed full-sized bit being placed in a hole that had become tapered, due to running the previous bit too long and allowing it to become undersized.

Sometimes very large openings in the nature of caves are encountered in the path of the drilling tools, and the hole can only be continued by letting sufficient slack on the cable to allow the tools to just touch the the bottom of the cave, and then operating them at a slow speed until a depth greater than the length of the drilling stroke has been reached. Should the cave or open space be greater than the full length of the drilling tools, a great deal of care must be exercised to see that the tools make a start below plumb or in line with the hole above.

In closing, particular emphasis should be laid on the importance of the human element in successful blast hole drilling. The drill man on any quarry job is the most important factor in the entire drilling and blasting operation. The drill man, on many quarry jobs, is the element that is going to make or break successful drilling. Where only one drill is operated, you can afford to consider the driller as one of the semi-skilled laborers—in the same class as a shovel crane man or a dinkey "skinner." Where there is more than one drill in operation, there should be a drill foreman in charge of all the drills and, perhaps, the shooting. He should be an experienced driller and capable to instruct and supervise other men as drill runners, who may be placed on a lower labor scale. In any event, the drill men should be put on a basis where they will take some interest in their work. It is often a very good practice to pay a drill man certain set wages per day, based on so many feet drilled. Over and above that number of feet, pay a bonus of so much per foot, or put him on a straight footage basis. The only possible danger on a proposition of this kind is with the upkeep of the equipment, so it is important that the man or men be of a type who will not neglect the equipment in order to make more hole and work for his own interest entirely.

Compressed Air Ram Bales Cement Bags

A very simple and efficient method of baling empty cement bags into neat tight bundles is with a compressed air ram. Many plants in which empty sacks or bags are used find plenty of uses for such a ram.



Cement Bag Baler Operated by Compressed Air

The handling of empty cement bags, sorting and binding them together, entails a great deal of labor which can easily be eliminated.

One person can count out a hundred bags, stack them under the air ram and turn the lever, and the ram presses them into a tight bale. The operator then ties the bags together and trucks them away. This method of baling is simple and efficient, and does away with a lot of unnecessary labor. Compressed air rams, similar to that shown in the illustration, are used for baling empty cement bags at the Dixon, Ill., and Toledo, O., plants of the Sandusky Portland Cement Co.

The compressed air ram bag baler is not for sale on the open market. The device was designed by W. E. Wuerth, superintendent of the Dixon, Ill., plant of the Sandusky Cement Co., and was made in the company's own shop.

Complaints Against Power Companies Dismissed

The complaints of the Alpha Portland Cement Co., Nazareth Cement Co., Coplay Cement Manufacturing Co., and the Penn-Allen Cement Co., against the rates of the Lehigh Navigation Electric Co., The Lehigh Valley Light and Power Co., and the Pennsylvania Power and Light Co. have been dismissed by the Public Service Commission of the Commonwealth of Pennsylvania, the Commission's conclusions being that the respondent, the Pennsylvania Power and Light Co., had successfully sustained the burden of proof cast on it by law. The case is of wide interest to power users in general, and involved the demands for reduction in power rates that would total $500,000 from the present charges of approximately $1,500,000 paid annually by the cement companies for electric power.

The case, which is referred to as the largest electric rate case determined by the Commission, bears upon the merger of the Lehigh Navigation Electric Co., the Lehigh Valley Light and Power Co., and other companies in the Pennsylvania Power and Light Co.; economy of operating expenses; property costs; exclusion of property; accrued depreciation and depreciation allowances; working capital; cost of financing; purchased power; allocation of fixed charges and operating expenses.

The Alpha, Nazareth and Coplay companies began receiving electric power service from the Lehigh Navigation Electric Co. in 1914 and the Penn-Allen Co. in 1917 under contracts which contained rate provisions averred to be in accord with the tariff then in effect. A rate increase, which became effective December 1, 1917, was accepted by the complainants without protest by agreement, the companies waiving any claim for reparation but without prejudice to any other rights under their contracts. On November 18, 1918, a further increase became effective without protest, apparently subject to the same or similar agreements. The first group of complaints was filed against the power company's schedule P-2, which became effective on October 15, 1919, it being alleged that the rates were excessive, unreasonable, and (by amendment) discriminatory and in violation of the rate provisions of the contracts. Hearings were held, and, before the case was completed, a further increase became effective on October 1, 1920, by the establishment of the power company's schedule P-18. This led to the filing of the second group of complaints, with similar general allegations.

On September 19, the Lehigh Navigation Electric Co. was merged with other companies into the Lehigh Valley Light and Power Co., which filed the answer to the first group of complaints. This merger was a first step in a more comprehensive plan which culminated in June, 1920, in the merger of the Lehigh Valley Light and Power Co. and other companies into the Pennsylvania Power and Light Co., which thereby became respondent in the proceedings. The complaints were consolidated for hearing, and were disposed of in one report.

The commission placed the burden of proof on the respondent power company. The amounts in the issue were very large; for example, the actual charges for service to the cement companies in 1921 totaled $1,495,445. The cement companies contended that a reasonable charge would have been about $1,000,000, or a difference of approximately $500,000 per year. The Commission gave the parties the fullest freedom as to time and extent and order of presenting their respective viewpoints. Numerous experts for both parties testified at great length, and wide differences of opinion were developed in detail, resulting in a record of over 7,800 pages of testimony and 143 exhibits, many of which were volumes in themselves.

Portland Cement Output in January, 1924

Statistics have been issued by the Department of Interior, prepared under the direction of Ernest F. Burchard, of the Geological Survey, based mainly on reports of producers of portland cement, but in part on estimates. The estimates for Januray, 1924, were made necessary by the lack of returns from two plants. Production appears to be the highest recorded for any January; shipments are the highest for the month, except January, 1923; and stocks have been exceeded only a few times, as, for instance, early in 1916 and 1922.

Stocks of clinker or unground cement at the mills at the end of January, 1924, amounted to about 5,460,000 bbls., as compared with revised stocks of 3,783,000 bbls. at the beginning of the month.

Production of finished portland cement for the month of January, 1924, was 8,788,000 bbls.; shipments for the same month amounted to 5,210,000 bbls. and stocks at the end of the month were 14,153,000 bbls.

The Bureau of Foreign and Domestic Commerce, of the Department of Commerce, reports that the imports of hydraulic cement in December, 1923, amounted to 104,422 bbls., valued at $170,941. The total imports in 1923 amounted to 1,678,636 bbls., valued at $2,964,098. The imports in December were from Belgium, 64,257 bbls.; Denmark, 20,172 bbls.; Norway, 15,424 bbls.; Sweden, 2,782 bbls.; Canada, British Columbia, and Yukon, 834 bbls.; Quebec and Ontario Provinces, 298 bbls.; France, 554 bbls.; England, 101 bbls. The imports were received in the following districts: Los Angeles, 57,168 bbls.; Porto Rico, 20,172 bbls.; New York, 15,936 bbls.; Florida, 4,552 bbls.; San Francisco, 3,562 bbls.; Massachusetts, 1,025 bbls.; Washington, 834 bbls.; Galveston, 774 bbls.; other districts, 399 bbls.

The exports of hydraulic cement in December, 1923, were 80,487 bbls., valued at $227,912, of which was sent to Cuba, 42,135 bbls.; to the other West Indies, 5,218 bbls.; South America, 13,409 bbls.; Mexico, 10,099 bbls.; Central America, 6,026 bbls.; Canada, 1,381 bbls.; and to other countries, 2,219 bbls.

Although the statistics of imports and exports of hydraulic cement in January, 1924, are not available, imports for the month of December, 1923, compiled from records of the Bureau of Foreign and Domestic Commerce, were 104,422 bbls.; exports for the same month were 80,487 bbls. The imports for the year 1923 were 1,678,636 bbls., and the total exports for the same year were 1,001,688 bbls.

Large Kiln Constructed by Oxy-Acetylene Welding

A few weeks ago the largest single piece of plant equipment ever fabricated by oxy-acetylene welding was completed: a huge kiln, used in the manufacture of calcium carbide. As shown in Fig. 1, it was shipped to the customer on four flat cars, an indication of its size and weight.

It can readily be appreciated that the stresses to which such equipment is subjected are extraordinarily severe. These are induced by the weight of the kiln itself and its lining. and that of the material in it, by the heat applied to treat the contents and by the forces which cause the kiln to revolve.

To successfully meet these exacting requirements imposes a severe test, not only on the steel plate of which the kiln is built but even to a greater degree upon the joints. Regardless of the severe service expected in actual use and the tests which were made on this welded kiln during manufacture every requirement of the purchaser has been successfully met. There is every reason to believe that this kiln will give service at least as satisfactory as the same type of equipment built by the older methods, and the probabilities are that the welded kiln, from the nature of its construction, will stand up even better than those with rivetted joints.

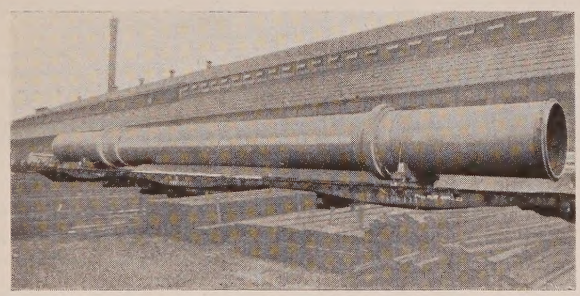


Fig. 1—Carbide Kiln Ready for Shipment

The kiln has an overall length of 125 ft. It is 8 ft. in diameter and is built of ⅝-in. steel plate. It is pointed out in *Oxy-Acetylene Tips*, from which the following information was obtained, that although the customer's specifications permitted a diameter tolerance of ⅝ of an inch, the completely welded kiln was off dimension only ½ in. in diameter on one end and ⅜ in. on the other. These variations are well within the allowance for eccentricity which must be made in rivetted construction.

While the carbide kiln was in the process of construction three dryers were also built. These are 50 ft. long, 5 ft. diameter, and are fabricated of ⅜-in. plate. Building these dryers was conducted as a fill-in job while sections of the kiln were being aligned and prepared for welding; and this made possible utilizing time of the operators to the highest degree of efficiency.

In reality, the building of the kiln and the dryers was conducted as a succession of small jobs, these smaller jobs being completed individually and then incorporated into the major construction. The kiln was built in 10 sections, eight of these being 8 ft. in diameter and 8 ft. long and formed by one piece of rolled plate, the other two being 30 ft. 6 in. in length, 8 ft. in diameter and built from three pieces of ⅝-in. plate.

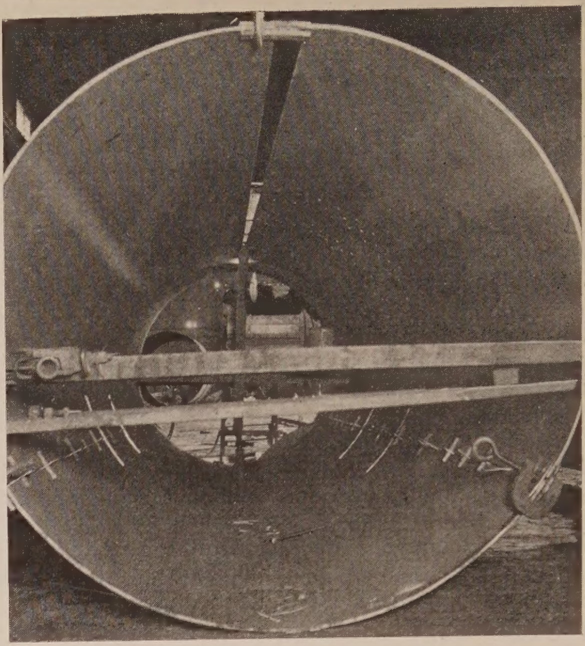


Fig. 2—Ready for the Welders

The actual welding practices involved in this work were not different from those ordinarily considered best for building large tanks and handling heavy steel plate. The plate was beveled in the mill, from both sides for the circumferential seams and from one side only for the longitudinal seams. After the plate was delivered to the shop it was punched with the necessary rivet holes for attaching the tires and other parts which require replacing from time to time. Then it was bent to shape in powerful rolls.

To obtain a maximum of strength in the welded joint a nickel steel welding rod was used. Numerous welds made on the job with this welding rod in test coupons proved to have practically the same tensile strength as the original plate.

The 8-ft. long sections were built from one piece of plate approximately 25 ft. long rolled into an 8-ft. diameter circle. Welding one longitudinal seam completed each section as a unit, and the completed sections, as they were finished were aligned and joined to others by welding the circumferential seams. The two 30-ft. 6-in. long sections were also completed as units by welding. These were built of three plates, each slightly more than 8 ft. wide and the proper length. The plates were rolled along the short dimension, and the three segments fitted into a complete circle by welding the three 30-ft. 6-in. longitudinal seams. These, of course, were also fitted into their place in the kiln by welding the circumferential seams.

The allowance for expansion and contraction in the plate depends upon the thickness of the plate, the length of seam and the speed of the welder. In the course of this work a ⅜-in. opening between each of the sections was necessary to compensate for the contraction in the girth weld. It was found that this space was reduced to ¼ in. after a joint had been tack welded at eight or ten different points in its circumference and allowed to cool. This allowed a full quarter of an inch for the contraction of the first weld, which penetrated one-half of the plate thickness. The welding of the second half of the plate thickness had

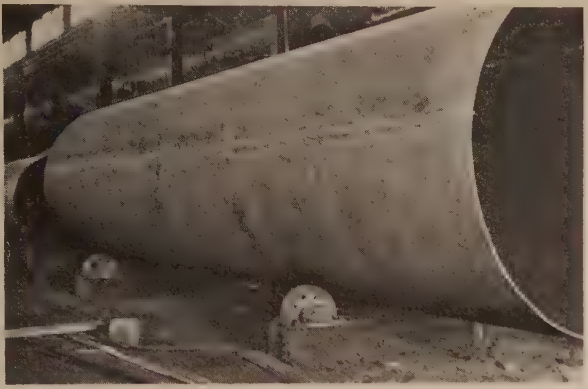
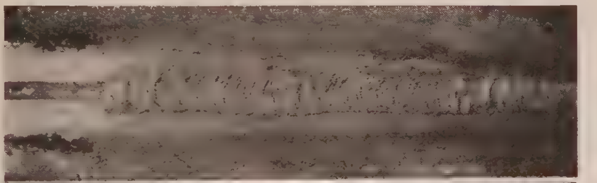


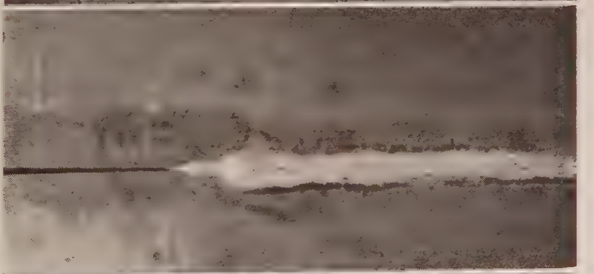
Fig. 3—Longitudinal Seams Completed

quite an annealing effect on the first weld and the contraction of the second weld also had a tendency to upset the weld previously made, pushing it outward and giving it the appearance of being reinforced to an extreme degree. Immediately this was noticed and orders were given to discontinue reinforcing the first side and to more heavily reinforce the second side, this resulting in a finished seam, when cooled, having the same appearance on both sides.

It developed that the alignment of the kiln depended largely upon the facilities for properly setting up the plate for welding. A sufficient number of the proper kinds of clamps and rolls properly used assured the proper set up. As successive sections were added to the kiln the previously welded sections were revolved on rollers so that any departure from the true circle or a true line in the latest section added could be compensated for in adding the new section.

It has been mentioned that some attachments to the kiln were applied by rivetting. The rivet holes for this equipment had been punched in the plate before the plate was rolled. When the kiln and the dryers were completed these rivetted attachments were easily applied and it was found that only a normal amount of reaming was necessary to make the rivet holes match. (A certain amount of reaming is, of course, always necessary whether equipment of this kind is built by welding or by the older methods.) The matching of these holes furnished an excellent final test for the accurate alignment of the sections.





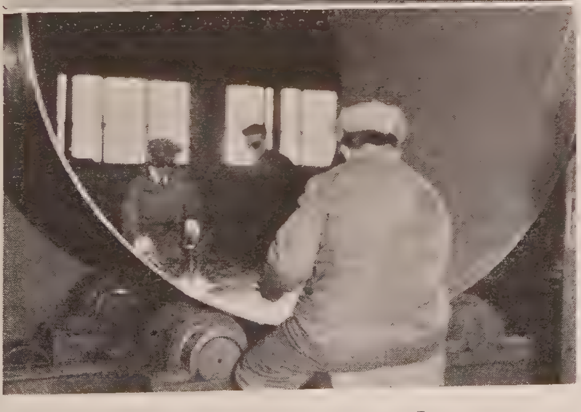


Fig. 4—Single Vee Weld, Viewed from Inside
Fig. 5—Double Vee Weld, in Process of Completion
Fig. 6—Welding Seam of Short Section

Cement Industry Ready for 1924 Demands

In reviewing the fact that the year 1923 was the largest in the history of the cement industry, B. F. Affleck, president of the Universal Portland Cement Co., pointed out that, except for short periods, sufficient labor was available, and the railroads performed feats that a year ago were considered impossible. The statement is attributed to Mr. Affleck in the *Journal of Commerce,* that even in these circumstances, it is doubtful whether the cement industry, and, in fact, the construction industry in general, could have carried on their affairs so effectively without a radical change in the habit of years standing of attempting to restrict a full year's activities into 6 or 7 months' time which had come to be known as the open construction season. In 1923, more than ever before, those directly interested put the habit aside and seized the opportunity to use the early months of the year to prosecute or at least get a start on their construction work.

It remains for those using or directing the use of cement and other materials to arrange for early shipments, and to get an early start on their season's work. In such an event, the cement industry, with its annual productive capacity of more than 150,000,000 bbls., stands ready to supply in 1924 to those needing it, a quantity of cement more than 50% in excess of the largest quantity ever used in a single year prior to 1922.

Methods of Testing Detonators

The results of an investigation of various methods of testing detonators, made by C. A. Taylor, explosives chemist, and C. E. Munroe, chief explosives chemist, Department of the Interior, tend primarily to emphasize the value of the sand test as a satisfactory method for estimating the strength and efficiency of industrial detonators and for fixing standards by which different types of detonators may be judged. As detonators of new compositions such as lead nitride or trinitroresorcinate are put on the market, a series of tests on each different brand can easily establish limits wherein each new type may be classified. Where detonators are to be tested in ordinary lots, or in commerce where a general classification rather than a precise chemical determination is desired, the sand-test method affords the simplest means by which this can be carried out. Its simplicity, and the ease with which it may be operated, mark its superiority and assure its practicability. Its efficiency may be somewhat impaired by the occurrence of variables of different natures; but this may be remedied to a great extent by standardization of materials and conditions of operation.

The Human Element, the Important Factor in Safety

By H. H. Purkhiser
Master Mechanic, Lehigh Portland Cement Co., Mitchell, Ind.

A paper prepared for the Twelfth Annual Safety Congress, Buffalo, N. Y., October, 1923.

It seems to me that the question of personal safety in any industry resolves itself at once into two principal factors or elements, the personal element and the mechanical element—the man and the machine.

This is true, however simple the machine or equipment—for a man with a pick and shovel presents the same principal elements, only in simpler form, that are presented by a man and an automobile, a man and a grinding machine, a screw conveyor, an engine or any other equipment or mechanical appliance.

There is a very important difference between these two factors or elements in that the one may be considered as having a more or less constant value and varies only from causes which can be seen or which can with reasonable care and forethought be anticipated.

A well-guarded machine in good repair does not usually and unexpectedly become a poorly guarded and unsafe machine without some visible and usually preventable cause. But how about the human element? The very many things that may occupy the mind of an individual, matters foreign to the work in hand at the time, and which can not be known or anticipated by any one else, make of that workman a very inconstant and variable factor in the matter of his own personal safety or that of his fellow-workman—unless a proper guard can also be placed on him that shall, so far as possible, make him a less variable and therefore a less hazardous factor.

It is this variable human element and its relation to the personal safety problem as we find it in the cement industry that I have been asked to consider and open for discussion at this time. The few remarks I shall have to make are based almost wholly on our personal experience at Mitchell, where we employ from 500 to 700 average men in two average cement plants, and the results we have obtained have led us to believe that our methods have perhaps some merit to them.

Like most, if not all, the organizations who have undertaken an intensive personal safety program, we considered first the matter of safe-guarding all machinery and making all places of employment safe places for our workmen, in so far as well-guarded machinery and good equipment could make them safe, notwithstanding the fact that we had usually received a "clean bill of health" and many compliments in addition from state factory inspectors. We recognized even then that the education of our men in *safe practices*, in methods of carefulness, was an important matter, but, while we frequently talked to our men along these lines, we had about come to the same conclusion that so many others had already expressed, "As long as we employ large numbers of men in any industry, we are going to have a good many accidents which can not be prevented." The number of days lost then by our employes as a result of injuries from accidents, due to carelessness on their own part or on the part of fellow-workmen, is a record of which we are not at all proud now, and even then we ranked fairly well with other cement plants.

It was not until the work of safety and accident prevention of all the Lehigh mills was coordinated, and we commenced to check up on the other fellow and in turn were checked up ourselves, that we put forth systematic efforts to educate the men, and succeeded in getting their keenest support in "cutting down" accidents and time lost as a result of accidents. The regular safety committee, consisting of the principal foreman and an additional man or two from the different departments, were requested to report *unsafe practices* engaged in by workmen and "fool stunts" that were either observed by them or brought to their attention; and we then and there commenced to reduce unsafe practices just as we had reduced the number of unsafe places, for men are very sensitive regarding criticism of their own actions by their fellow-workmen, and one important thing was being accomplished, that of the workman thinking not only *what* he was doing but *how* he was doing it.

The interest manifested in reporting unsafe practices among workmen led us to compare the records of the groups of workmen in the several departments and under the different foremen, some of whom had already made splendid records of many months without a single time lost accident, and right here is where we got the different foremen awake, by showing them their individual records for the past several months (number of accidents to men under his supervision), explaining that we expected to continue to classify according to the foreman in charge, and that their efficiency would be judged not only by the amount of work done, but also by how safely they could do it. This idea seemed to be satisfactory, and each one pledged to work for the best record, for not only did each foreman not want to have the worst record, but all knew that they would have to account to the Safety Committee in some satisfactory manner for the larger number of accidents reported from their department or among their group.

And may I say that the foremen have a man's size job in the training of men in the importance of safety.

They themselves should be sincere in every way and at all times.

They should make safety rules absolute and paramount, and commend those who follow the rules even to the simplest degree.

A classification of accidents by departments and groups brought out some astonishing records which hardly any one up to that time had realized, for it developed that some departments had gone well over a year without a single time lost accident, and this furnished another opportunity for interest and friendly rivalry, which we thought would be very helpful, so we began to make bulletins showing the length of time each department had gone without an accident. The following list shows the standing of the departments as of October 1st:

Department	No. Men	No. Days
General Repairmen	8	1376
Raw Department	37	1349
Kiln Department	17	1350
Sparksville Quarry	24	1047
Coal Grinding Department	13	982
Power Department	24	958
Shop	60	907
Clinker Department	27	896
Woodworking Department	12	791

Another plan we used was that of listing the causes from which our most common accidents occur, and we discovered that grinding wheels, cutting and chipping, and small holes in the bottom of cement bags were the causes of most of our eye injuries. We at once agreed to make it compulsory to wear goggles when grinding or cutting and chipping, and also to wear goggles and gloves when pouring hot metal. Since that time we have not had another accident from these sources, and as to the holes in cement bags, it required only a few inspection trips by the committee to find that the bag sorters were unaware of the importance of not passing any bags to the packers with holes, especially in the bottom. With proper instructions that fault was soon corrected, with the result that we have had no more accidents scoring against us from that source.

The menace of coal dust explosion, outstanding as it is in many cement plants as the source of many serious accidents, has been entirely eliminated at the Mitchell Mills, due wholly to close observance of safety rules.

At last we had "rung the bell" for we had reached the men in a way that made them take an active interest in our safety program, so that when on June 1st, 1921, we began our first No-Accident Campaign nearly every man was unconsciously a "watchdog" for unsafe practices. Right here let me say that you do not get a good start in a No-Accident Campaign unless you have created a live interest before the date when the campaign starts, and after it has started, keep in mind that there can be no "let up" in your efforts, because the minute you do you begin to drift, and you always drift down stream, not up, and for that reason we decided to adopt the school plan of holding regular classes for safety instructions. This we did, meeting once each week and bringing from thirty to forty men together, according to the number we could spare without interfering with our production, and there we reviewed the history of our safety work, explaining to each man that guarding the machinery did not reduce the number of days lost due to accident one bit, and made it plain to them that protection must be the first law and should be the motto of every man, pointing out that there is no justification for carelessness in an industrial organization, and that they would get nothing out of accident prevention without putting work and life into it, telling them that we were going to watch and see whether things were being done right or wrong, that we would appreciate every effort for safety. This, I think, got "under the skin," and all through our meeting we tried to appeal to the men in such a way as to actually make them feel that they would be responsible for the accident if they knew the conditions to be dangerous and did not make an effort to correct same or report it to the foreman or a member of the Safety Committee. We often used the illustration that if they could rescue a man from drowning or being killed by train, even at the risk of their own life, that they would feel very proud, and how do we know how many lives we have saved, families kept together, and ambitions prevented from being shattered, by our safety work. If any of you ever had the unpleasant experience of removing a fellowman from a screw conveyor, or helping dig him out of a coal or cement bin, or have been so unfortunate as to have to notify his loved ones of the fatal accident, I am sure you would agree that it is time to do something to prevent the recurrence of such a tragedy.

A man who is careless and takes a chance with his own life can not be depended upon to protect machinery and property, but, on the contrary, if he is a thoughtful and careful man, you can rest assured that he is a man who can be trusted with the care of machinery.

I like to think of our safety meetings as a dynamo which is continually generating safety current to every man in the mill, which keeps them active and alert at all times, and for that reason we have never postponed or cancelled a single meeting for several years.

The question may arise, how do you keep up interest? My reply would be that as long as the mill continues to make a record which is worth while, it attracts not only the attention and interest of the men employed, but also of the entire community, and men usually like to have a part in doing things worth while. To my mind, there is absolutely no question about the statement that accidents can be prevented, as is shown by the record of Mitchell Mill No. 2 for the past two years. In June, 1920, during our "No Accident" month, we just had one accident and that by "horse play"—one of the most persistent and also most inexcusable obstacles in the path of a good safety record. A water boy and fireman in the Coal Grinding Department had a wrestling match, falling on the concrete floor and fracturing a bone in the arm of one of the men. Then in July and August of that year we felt that the campaign was over, and did not make any special effort to prevent accidents, consequently we had more men hurt than in any other two months of that year.

In making up the 1922 safety program, we agreed that we should analyse the reports of all time lost accidents of previous years that we might know better along which line to work, and, to our surprise, we found that for the past four years we did not have an accident which a mechanical guard would have prevented, and that *all our efforts had been toward making the conditions safe for the men, rather than making the men safe for the conditions.*

I am thoroughly convinced that the greatest lesson that can be taught to each individual workman is to keep his mind constantly on what he is doing and where he is going, which is just as important, if not more so, than safety devices.

The article written by Arthur Brisbane and published in the November-December, 1921, Accident Prevention Bulletin, expresses my sentiments very forcibly. It stated, "There is never going to be any guarantee for the safety of human life that is not based upon the human factor. It is well enough to invent safety devices, but the best safety device in the world is intelligence. No amount of signs, notices, red lanterns, machinery or policemen can save an absent-minded man who will not look where he is going, from breaking his neck. Safety, in other words, along with many other things we think we can get by cleverness, can only be gotten through education. There is no short cut."

The ultimate aim of any safety committee should be to arouse an active conscious interest among all the workmen for a sufficient length of time to develop the *habit* of thoughtfulness and carefulness, for we are all to a large extent creatures of habit and do the right thing or the wrong thing as we have formed the right habit or the wrong habit. It is only as thoughtless, careless habits among foremen and workmen are wiped out and replaced by thoughtful, careful habits of doing work that any permanent value in safety and accident prevention is accomplished, for, when once developed, it is just as easy and natural for foremen and workmen to look about them for an instant and be, in a sense, unconsciously careful, as it is to begin and continue the work in a careless, thoughtless manner.

Thus step by step we enlisted the interest and active cooperation of our men, until we feel we have developed among them, to some extent at least, the *habit* of carefulness to which we attribute mainly our large reduction in all accidents, especially the more serious accidents, and we believe that we have awakened among them a deeper human interest in each other's personal safety and welfare, to prevent keen suffering and keep their fellow-workmen's wives from becoming widows and their children from becoming orphans, and at the same time establishing a record which we think is unequaled today in that of operating a mill employing 450 men, working 1,383,475 man-hours for a period of 17 months, without an accident causing the slightest inconvenience to a workman.

We work through the foreman. We put the responsibility squarely up to the foreman in such a way that he is the man that leads the group. A foreman must be a man who is a friend to the men, who can meet John and Henry and ask about the wife or the kiddies or the folks at home. He should have an individual message for the man when he meets him. A foreman should consider himself an inspector, hourly going from department to department to see whether the work is done right or wrong, and be able to tell the man how to do it right. A foreman should be an inventor, constantly trying to simplify the work and make it safer and easier for the man. He should be an organizer who can hold his men and hold his place as foreman of those men. He has to be a hustler, a mechanic, knowing every phase of the work, so he can tell a man that the job is being handled wrong and why it won't work to do it that way. He must be a teacher, a leader, able to train the men in safe practices. We tell the foreman that the Lehigh is anxious to make all the cement possible, but we don't want to make cement at the cost of his blood or the blood of others.

The foreman is in constant supervision of his men, with them at all times. If something is required he sends some one else to the storehouse, but he stays with his men.

We convene, say, every fourth Tuesday at 9:30 for a Safety Meeting, with every man on the job. We can't give the safety work on spare time and get anywhere. All of our most important men find time to come.

Cementing Qualities of Calcium Aluminates

Owing to the interest which has been aroused by "fused" or "high alumina" cements, it has been found necessary to print additional copies of Bureau of Standards *Technologic Paper No. 197 Cementing Qualities of the Calcium Aluminates.* This paper gives the data obtained from test pieces made of eight different cements of this type, burned in the experimental plant at the Bureau. In addition to the usual small mortar test pieces, as required by the specifications for portland cement, 6 x 12 cylinders of a 1:6 and 1:12 gravel concrete were made and tested at various periods up to and including 3 years. In general, the results confirmed the statements issued abroad in regard to the early hardening of these cements, as evidenced by a strength of 3,145 lbs. per sq. in. for a 1:6 concrete at the end of 24 hours, and 880 lbs. at the same period for a 1:12 concrete. In view of the fact that the 3 year data presented in the paper was obtained during 1920, and the data for the earlier periods at a time previous to that, the Bureau is now engaged in making more of these cements to investigate such important points as the resistance to sea water and sulfate waters. In the meantime, copies of *Technologic Paper No. 197* may be purchased from the Superintendent of Public Documents, Washington, D. C., at a price of 10 cents per copy.

Lehigh to Enlarge Birmingham Plant

The Lehigh Portland Cement Co. has let the contract for an addition to its Tarrant City plant, which will increase the output practically one-third, according to reports from Birmingham, Ala. The production of the plant with the new addition will be approximately 5,000 bbls of cement per day. The contract for the new construction has been let to Dwight C. Robertson & Co., of New York.

The Lehigh Portland Cement Co.'s plant at Tarrant City, a suburb of Birmingham, is one of the newest cement plants of the Birmingham district. This plant was completed during the summer of 1923, at a cost of over $1,000,000. The company commenced shipping cement last September, and since that time the demands on the plant for cement have grown steadily, so as to make the increase in capacity necessary. The present plant has three kilns, each 190 ft. long. A fourth kiln is to be constructed, and a considerable amount of other work, in the way of improvements, is to be done about the plant.

The Lehigh Portland Cement Co. is one of the biggest cement producers in the United States, with headquarters at Allentown, Pa. It is announced that W. Jess Brown, former sales manager of the National Portland Cement Co., with a plant at Ragland, Ala., has taken a position with the Lehigh Co. in the sales department. Mr. Brown, together with F. M. Traynor, sales manager for the Lehigh Co. in the Birmingham section, returning from a meeting of the sales forces of the company, held at Allentown, Pa., reported that the prospects for heavy sales of cement during the present year are most flattering in all sections of the country.

It is understood that the plant of the Lehigh Portland Cement Co., at Tarrant City, Ala., is intended to supply the southern trade for the company. Owing to the greatest building activity ever known in the south, the demand for cement is greatly on the increase, making it necessary to increase the capacity of this plant, to supply the increased southern trade. At the present time more cement is going into business blocks, private residences and general construction work and public highways than ever before in the history of the south, and the demand for cement along these lines is constantly on the increase. Owing to the rapid decrease in the once virgin forests of the south, cement is taking the place of timber more and more with the coming years.

Rubber Lined Ball Mills in Mining and Cement Industries

Abstracted from *India Rubber World,* Dec. 1, 1923.

In the manufacture of portland cement, exceedingly fine grinding of cement rock, limestone, coal and clinker constitutes a prominent feature of the process. For grinding the cement rock and limestone, a tube mill is generally used, an improved form of which, called a compeb tube mill, is shown in Fig. 1.

Tube Mills

A tube mill consists primarily of a long, revolving cylinder of steel provided with a lining of suitable material to form an inner abrasive surface and protection from wear for the outer shell. The ends of the cylinder are closed by heavily reinforced cast iron heads which have at their centers hollow trunnions through which the material is fed into the mill at one end and discharged at the other.

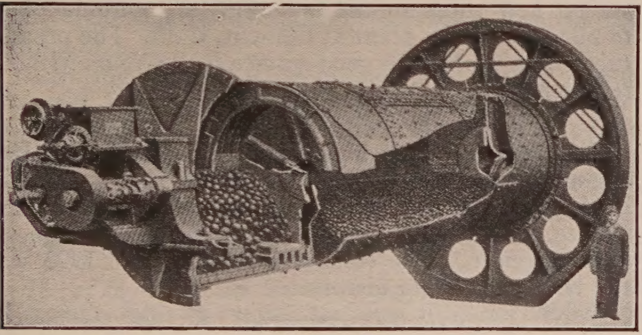


Fig. 1—Compeb Mill Showing Interior Arrangement and Charge of Grinding Balls

The cylinder is partially filled with flint pebbles or iron balls which are replenished from time to time as their quantity is reduced by wear. The rotation of the cylinder carries the mixture of pebbles or balls and the material being ground to a certain height within the mill, from which the mass falls, and in falling the pebbles or balls are in constant action against each other, and between them the material is ground by attrition. By this principle of grinding, an immense grinding surface is brought into constant action and every particle of material is subjected to uniform and thorough grinding.

The number of revolutions at which the mills are operated depends upon their diameter and the material to be ground. Usually the speed is regulated so as to give the shell a peripheral speed of approximately 400 ft. per minute.

In customary practice the lining for the interior of the shell of a tube mill may be made of silex, ironite, or cast iron applied in sections bolted to the shell. This method of applying the lining is shown in Fig. 2, which represents an interior and sectional view of a tube mill with sectional ribbed lining of cast iron. A lining of this type requires about 24 hours for replacement ready for again operating the mill. When a silex lining is placed in the mill it is necessary to allow the cement, which holds it in place, to harden before the mill can be used, a period usually of a week to ten days. This periodic loss of time involves a serious reduction in tonnage, which until recently there seemed to be no way to avoid.

Rubber Linings in Ore Grinding

Tube mill grinding finds extensive application as a process of ore dressing in the mining industry where possibly as much rock is ground as in the cement industry. The cost of linings and the possible increase of grinding efficiency recently led to experiments with thick slabs of tough, wear resisting rubber applied as a lining to a tube mill grinding very hard ore and gangue rock.[1] After months of practical test it was demonstrated that the innovation of the rubber lining gives results superior to any of the metal and rock linings previously used. These results apparently indicate that tube mills working on cement rock, limestone, and the intensely hard cement clinker might be operated with rubber linings with equally satisfactory results. In such cases the general adoption of rubber for linings would be a new outlet for the mechanical goods industry of no small proportions.

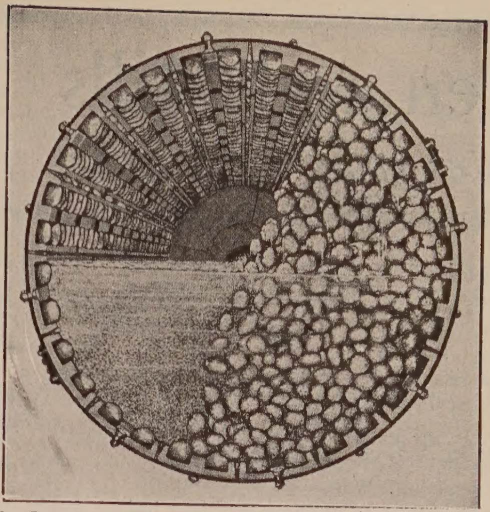


Fig. 2—Sectional View Showing Ribbed Tube MillLining

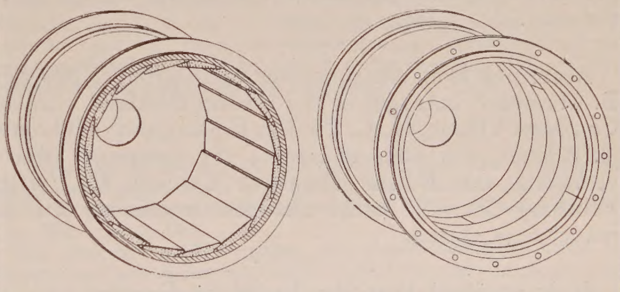


Fig. 3—Two Methods of Applying Rubber Slabs for Lining Ball Mills. In the Upper Figure the Linings are Circumferential and in the Lower They are Longitudinal

The matter of rubber linings for tube mills has been made the subject of a recent patent[2] in the specification of which reference is made to two methods of applying the rubber slabs, one circumferentially and the other longitudinally, as represented in Fig. 3. The grade of rubber recommended is that used for the tread of automobile tires. Such a lining while sufficiently hard to resist wear has enough resiliency to cause the steel balls or other grinding medium to rebound upon impact in such manner as to avoid disintegration of the liner surface. Also the rebounding action produces a very marked increase in pulverizing efficiency. Such a lining is much lighter in weight than those heretofore used, consequently the less heavily weighted mill requires much less expenditure of power for operation. The replacement of the rubber lining is a comparatively simple matter and may be effected very rapidly.

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[1] "Rubber Lined Ball Mills." *The India Rubber World,* August 1, 1923, 697-8. "Rubber Possibilities in the Mining Industry," *The India Rubber World,* November 1, 1923, 87.

[2] United States patent No. 1,470,597.

Men and Mills

Notes from the Field

The new lime plant of the William L. Urschel Lime & Stone Co., at Gibsonburg, Ohio, is rapidly nearing completion. The kilns were installed by Arnold & Weigel, Woodville, Ohio, and all other work and construction were supervized by F. Weber, superintendent for the Urschel company. Mr. Weber was formerly superintendent of the Washington Building Lime Co., Woodville, Ohio.

A number of improvements are being worked out at the portland cement plant of the Louisville Cement Co., according to the *Speedometer*. Motors on kilns Nos. 1, 2, 3 and 4 are being replaced with variable speed motors. Speed reducers will take the place of the pinions and gears on the clinker elevators.

A Fuller-Kinyon pump will be installed to pump powdered coal to the kiln and dryer rooms, eliminating all screw conveyors handling coal.

The San Joaquin Portland Cement Co. has been organized by the officials of the Old Mission Portland Cement Co., San Francisco, Calif. Plans are under way for a cement plant to be constructed near Three Rivers, Calif. While definite plans have not been announced by the new company, it is expected that the plant will have an ultimate capacity of 3500 bbls. per day.

According to an announcement attributed to Stephen B. Mambert, manager of the Edison Portland Cement Co., New Village, N. J., Charles Edison, son of Thomas A. Edison, will have charge of the company affairs, including the Edison Portland Cement Co., after February 28. No other changes in officials will be made, it is stated.

It is reported that the Lawrence Cement Co., of Northampton, Pa., has obtained a large farm near Bath, upon which it has been drilling for some time, finding the finest of cement rock.

Shipments of cement from the Lehigh field in February will exceed those in January by several thousand barrels. All the mills have a sufficient supply of coal, the labor situation is better than it has been for some time, and plants are being operated at capacity, with prospects very bright for a lively spring demand, according to reports from that locality.

John L. Senior, president of the Signal Mountain Portland Cement Co., has recently been appointed treasurer of the newly formed Arthur McMullen & Senior Co., with offices at 111 W. Monroe St., Chicago, Ill. The new company was organized by the Arthur McMullen, Co. of New York, to facilitate the execution of contracts for engineering construction in the Middle West, and to extend its operations in that territory.

At the annual meeting of the stockholders of the Alpha Portland Cement Co., held recently, President G. S. Brown and Treasurer John J. Matthes submitted their annual reports, which showed that the company has had a most successful year. During the past year, it is reported, a new waste heat boiler has been installed at No. 4 mill, Martin's Creek, and is now in operation.

The directors organized by electing G. S. Brown, president; Frank G. McKelvey, F. M. Coogan and C. A. Irvin, vice presidents; John G. Matthes, Phillipsburg, treasurer; F. G. Lyons, Easton, assistant treasurer; Robert S. Gerstell, Easton, secretary; W. E. Viets, Chicago, Ill., assistant secretary and assistant treasurer.

The Tidewater Portland Cement Co. has reported a splendid record in its "No-Accident" campaign during the year just closed, with but 9 lost-time accidents, compared with 15 in 1922 and 37 during 1921. During the past year, 4 months and 21 days elapsed at one time without a single accident. Meanwhile, a "don't-get-hurt" campaign is being conducted, and it is hoped to make a still better showing this year than last.

The Pacific Portland Cement Co. has recently installed new tubes in the boiler in its pumping plant to pump oil to the plant at Cement, Calif. The present tubes have performed good service for 18 years without replacement.

The Bradley Pulverizer Co., of Allentown, Pa., announces the addition to its staff, on Jan. 1, of J. G. Burke, as engineer in charge of development and service, and of A. W. Catlin, formerly of Chicago, as sales engineer. The company reports that 1923 was the best year in its history.

The report that the Cement Securities Co. would reduce the par value of its stock from $100 to $25 per share, making it more attractive to the small but consistent buyer, is contradicted from Denver. According to statements attributed to Claude Boettcher, vice president of the company, the matter has never been discussed by the directors, because it has not even been contemplated. The stock is reported to be paying $12.00 annually per share, or more than 8%, and is hard to obtain on the market.

P. G. Paris, director of the Westport mill, investigation and testing laboratory of The Dorr Co., engineers, has resigned to return to the Bethlehem Steel Co., with which he was formerly affiliated. He will be connected with the patent and research department, and will be a consultant on ordnance work.

The directorship of the Westport mill will be taken over in the near future by J. A. Baker, who was formerly connected with The Dorr Co.

Mr. Baker, who prepared at Sheffield Scientific School and the Colorado School of Mines, has had a wide experience in mining and metallurgical work. From 1919 to 1922 he was director of the Westport mill, but was forced to resign on account of ill health.

He has fully recovered, and is now making a tour of inspection of some of the company's present engineering activities, prior to assuming his duties at Westport.

Good progress is being made with the construction of the new cement plant of the Manitowoc Portland Cement Co., Manitowoc, Wis. The stockhouse and packhouse are practically complete, and all heavy machinery, such as kilns, coolers, heavy motors, etc., in the main mill are in place. The building is entirely under roof.

The Olympic Portland Cement Co.'s factory at Bellingham, Wash., began operating at full capacity on February 4, giving employment to 150 men. The plant has a daily capacity of 2,000 bbls, and the company reports the market outlook to be very good.

Burton E. Miller, of Hudson, has been made temporarily directing head of the Hudson Valley Cement Co.'s plant at Alsen. Resigning three weeks ago as plant manager and superintendent of the New York and New England Lime & Cement Co.'s plant at Hudson, Mr. Miller has been secured by the directors of the Hudson Valley company to investigate the plant's resources and plan for expansion and increased production.

Colonel H. C. Boyden, of the Portland Cement Association, addressed the twenty-first annual convention of the Mountain States Lumber Dealers' Association, in Denver, Colo., the latter part of January.

The Colonel carried his audience from the early days of cement making up to the present, and explained just why concrete construction has advanced since the making of cement had been scientifically standardized.

Carrying the subject from the mixer until it is laid, he told just how slip-shod methods of mixing and laying were the causes of practically all the troubles met with in concrete work. At the conclusion of his address many questions were asked and answered, the lumber men securing many valuable pointers as to why concrete will be helpful to them.

It is reported an aerial tramway that will cost $100,000 will be built by the Superior Portland Cement Co. to transport rock from its quarry to its cement plant at Concrete. The tramway will be made necessary by the construction of a dam on the Baker river by the Puget Sound Power & Light Co., which has started work preliminary to the construction of a power plant that eventually will cost $5,000,000 or $6,000,000.

At the annual meeting of the shareholders of the Oregon Portland Cement Co., held early in January, Edward Cookingham, president of Ladd & Tilton Bank, Portland, Ore., was elected a director to take the place of George MacDonald, resigned; and R. P Butchart, of Victoria, B. C., M. J. Ballard, of Salt Lake, Utah, and A. H. Devers, Chester Dolph, F. I. Fuller, George Lawrence, L. C. Newlands and A. S. Pattullo, of Portland, were re-elected directors.

The directors re-elected R. P. Butchart, president; L. C. Newlands, vice president and general manager, and C. V. Dolph, attorney. C. W. Gath was chosen secretary and treasurer to succeed George MacDonald, resigned, and H. P. Davidson was re-elected assistant secretary and treasurer.

Trade Publications

The C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., has just issued a new catalog, No. 904, 16 pages, paper covers. This booklet covers the whole Tag line, briefly describes each type of instrument, including: industrial thermometers, automatic controllers, recording and dial-indicating thermometers, vacuum gages, mono gas-analysis recorders, oil testing instruments, hydrometers, laboratory thermometers and other products, with numerous illustrations. This booklet is free to anyone interested.

The Pennsylvania Crusher Co., Philadelphia, Pa., has just issued Bulletin No. 1014, *Pennsylvania Hammer Crushers*, illustrating and describing Pennsylvania steel-built hammer mills for cement, lime and gypsum plants.

These hammer mills have been developed for the secondary and finer reductions of limestone, cement rock, gypsum, shales and similar materials in the process of manufacturing cement, lime and gypsum products, and for brick, chemical and other manufacturing plants employing materials which can be reduced in a similar manner.

Unbreakable steel frames, tramp iron separator, quick adjusting cage, oversize bearings, heavy manganese internal parts and enormous "working stamina" are cited as the major characteristics of these mills.

Copies of this bulletin will be sent to manufacturers who are considering equipment of this character, or who desire it for their permanent reference files.

Thrift in Lifting is the name of a 32-page, paper-cover booklet, No. 5060, issued by Herbert Morris Incorporated, Buffalo, N. Y. This book was planned to give practical information in concise form on material handling machinery. A few standard types of Morris cranes are dealt with in this book: there are many other standard designs, as well as a big range of semi-special cranes from which to choose. The accumulated experience from field, factory and laboratory of the associated Morris organizations has been consistently incorporated into the hand-cranes bearing the Morris name. Single beam cranes, crane runways, underhung cranes, crane trolleys, double beam cranes, jib cranes, triple-gear chain-blocks, traveling worm-gear blocks, overhead monorail tracks, platform hoists, and slings of various types are some of the things discussed in the book.

Armstrong All-Steel Blast Hole Drills is the name of a new bulletin issued by the Armstrong Manufacturing Co., Waterloo, Ia., 23 pages, paper cover, illustrating and describing the All-Steel traction and non-traction models in detail. The Armstrong all-steel blast hole drill is presented as the most marked improvement in blast hole drills since the churn type first came into use in the quarry industry. Six important improved features are brought to the attention of the reader, viz.: All-steel frame, with every piece hot riveted in place; derrick constructed entirely of steel; low-down construction, with all bearings mounted directly on the main sills; band wheel mounted between two heavy steel sills, with no over-hang or side draft; crown sheave, spudding sheave and heel sheave, all of extra large diameter, and a clutch controlling the drilling motion, which is built to carry five times its normal load and guaranteed against breakage from any cause for the life of the machine. Copy of this bulletin will be sent to anyone requesting it.

Conquering the Earth is an elaboration of the events through the ages from stone hatchets to dynamite, upon which a series of historical advertisements was based, published by the Hercules Powder Co., Wilmington, Del.

The book is 9 x 12, 64 pages, with paper covers. It is rich in illustrations and descriptive matter about the early methods used in quarrying and mining. The information recorded on such subjects as "Quarrying for Solomon's Temple," "The Pyramids of Gizeh," and "The Great Wall of China" is based upon standard history and books of reference.

A new concisely arranged service chart covering belt joining has recently been issued by the Crescent Belt Fastener Co., makers of Crescent plates, Crescent rivets and Crescent rivet extractors. This chart is in card form, size 3½ by 9 in., and covers completely and specifically the means and methods to insure best results under all conditions of work. The indexing is by columns, and covers all dimensions of belting from ¾ in. to 18 in. and larger in width.

The specifications given cover leather belting in light, medium and regular; single, double and triple weights; and all kinds of fabric belting, rubber, canvas, balata, hair, etc. by plies. On the back of the card prices are given.

This service chart is known as *Form N. Y. 298*. As many copies as desired can be had by addressing the Crescent Belt Fastener Co., 247 Park Avenue, New York, N. Y.

Milwaukee Gasoline Locomotives is a 16-page illustrated publication, size 8½ in. x 11 in. issued by the Milwaukee Locomotive Mfg. Co., Milwaukee, Wis., describing Type H. Milwaukee Gasoline Locomotives. Many of the new and exclusive features that have been incorporated in the design of Milwaukee gasoline locomotives are described and illustrated and the equipment is recommended as a most practical and economical form of motor power for transporting materials and supplies in and around manufacturing plants, lumber mills, stone quarries, sand and gravel pits, brick yards, cement works and fertilizer plants as well as for road building and general construction work.

Burlap in the Cement Field

That the burlap trade was misled during 1923, and that it expected a small jute crop but realized a large one, is pointed out by George W. Billups in a recent issue of the Journal of Commerce, New York City. The Continent is referred to as a growing competitor of Calcutta. It is cited that Dundee has for many years past been declining as a factor in the burlap market, and now in standard weight goods it is entirely obsolete. Although Dundee has and always will continue to a greater or less extent to manufacture odd weight and odd constructions, the chief point of interest in the burlap manufactured outside of Calcutta is claimed to be the large increase of Continental and chiefly German burlap.

In regard to new uses for burlap, the following statements are made in the article relative to the portland cement field:

> There is one chief new use to which burlap has been put in 1923 in considerable quantities, and that is for the manufacture of jute cement bags for portland cement. Cement companies in the United States have been using an osnaburg bag for cement, although the Continental cement companies have been for years using a jute bag. It is only since the beginning of 1923 that the cement companies here have been realizing that they can buy a jute bag at approximately $100 per thousand less than osnaburg, and it serves their purpose as well as an osnaburg. Considering the difference in price, the saving on the yearly replacements which are required by the cement companies would, at today's value, figure about $6,000,000 initial saving; a much greater saving it seems in the end is made, owing to the superior strength and durability of 15-oz. jute bags.
>
> There are about 60,000,000 bags replacement needed by the cement companies in the course of a year, and this year about 15,000,000 of these were replaced by jute. This year will, I believe, see at least 25,000,000 so replaced. It seems only reasonable to believe that eventually osnaburg will figure less for this use, and also that the particular grade of jute cloth that will be used will be 31-15-oz., count about 11 x 13. After many tests that have been made this seems to be the best construction.
>
> Dundee, relying for its existence on odd grades, and undersold by Calcutta and the Continent on the above grade, has tried to push lower weight, higher count goods, as on this construction they do not get the same competition from Calcutta and the Continent. However, these goods seem to be unreasonably high in price in comparison, and it does not seem that they will continue to be used much.

Security Company to Make Cal

The Security Cement & Lime Co., Hagerstown, Md., has acquired the rights to the patents of the Cal Chemical Co., retroactive to March 1. The sale of Cal will be handled by the Security Cement & Lime Co., and will be manufactured at the lime plant at Berkeley, W. Va., near Hagerstown.

The Security Cement & Lime Co., will also take over the personnel of the Cal Chemical Co. and the New York and Chicago offices. Richard H. Catlett will be manager of the Cal Department of the Security Cement & Lime Co.

Industries representing over 90% of the gypsum producers recently adopted a unanimous resolution urging the Interior Department, through the Bureau of Mines, to undertake work on the utilization of anhydrite. Some preparatory work along this line has been performed at the Non-Metallic Mineral Experiment Station of the Bureau of Mines, New Brunswick, N. J., and laboratory work will be begun in the near future.

BETTER BRICK FOR KILN LININGS

The severe usage imposed on kiln linings by the cement industry makes the choice of proper fire brick a big factor in the length of service of any kiln.

Highly refractory, uniform texture, low-spalling, tough and resistant, Ashland Fire Brick is burned to meet the exacting conditions of the cement manufacturer.

38 years of experience in grinding, tempering, molding and burning fire clay permit the full utilization of the exceptional qualities of the Ashland flint-clay deposits, and results in a product that outlasts less carefully made brick.

Ashland Fire Bricks have given entire satisfaction to users the country over for many years. Write for detailed booklet and the address of the Ashland warehouse nearest you.

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